ABSTRACT

Flight Experiences of the ATMOS Experiment — Lessons Learned —

by
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Designed and built between 1979 and 1981, the ATMOS (Atmospheric Trace Molecule Spectroscopy) experiment is now *14* years old. It is the veteran of three space flights beginning within the Spacelab-3 mission on the space shuttle *Challenger,* in April 1985. This was followed by two flights as a principal component of the ATLAS (Atmospheric Laboratory for Applications and Science) series of missions. The ATLAS-1 flight took place in late March 1992, on the *Atlantis.* The ATMOS experiment's most recent flight was on the ATLAS-2 mission on April 8-16, 1993. Launched on board the *Discovery,* this mission was also an engineering evaluation flight for a new dedicated high data rate recorder system. As it turned out, this recorder succeeded in capturing ATMOS' only observational data when a key Spacelab/shuttle data telemetry subsystem failed. The ATMOS experiment is scheduled to fly on future ATLAS missions through the year 2000. In between missions, ATMOS collected a large set of ground-based atmospheric observations from JPL's Table Mountain Observatory facility.

To date, the ATMOS Instrument has accumulated over 2,500 hours of system operation. The interferometer slide mechanisms have operated for over 2.2 million cycles and it still uses the original HeNe laser tube and cryogenic cooler compressor. Much of the original ATMOS design was dictated by the unique Spacelab interfaces and by the shuttle's flight environment. Its design utilized a combination of state-of-the-art technology (circa 1980), specially developed hardware, and off-the-shelf equipment. This combination has generally worked very well.

These flight experiences have taught us many lessons about the design and operational use of complicated scientific instrumentation in a shuttle environment. These lessons will be described and summarized so that future instruments can benefit from the experience of the ATMOS experiment.